LM837 Low Noise Quad Operational Amplifier

Check for Samples: LM837

FEATURES

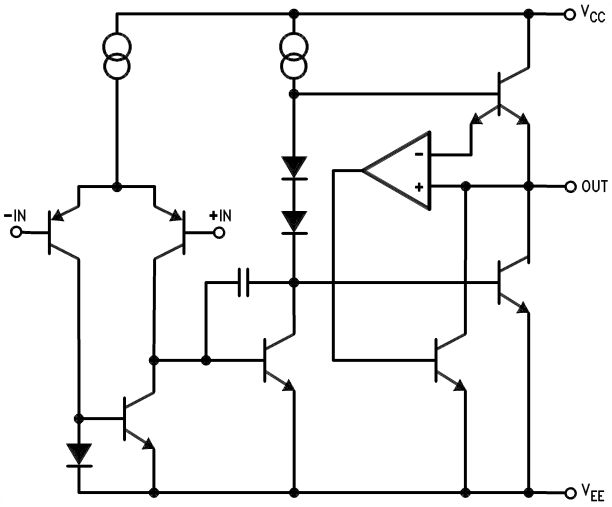
- **High Slew Rate 10 V/µs (typ); 8 V/µs (min)**
- **Wide Gain Bandwidth Product 25 MHz (typ); 15 MHz (min)**
- **Power Bandwidth 200 kHz (typ)**
- **High Output Current ±40 mA**
- **Excellent Output Drive Performance >600Ω**
- **Low Input Noise Voltage 4.5 nV/$\sqrt{Hz}$**
- **Low Total Harmonic Distortion 0.0015%**
- **Low Offset Voltage 0.3 mV**

DESCRIPTION

The LM837 is a quad operational amplifier designed for low noise, high speed and wide bandwidth performance. It has a new type of output stage which can drive a 600Ω load, making it ideal for almost all digital audio, graphic equalizer, preamplifiers, and professional audio applications. Its high performance characteristics also make it suitable for instrumentation applications where low noise is the key consideration.

The LM837 is internally compensated for unity gain operation. It is pin compatible with most other standard quad op amps and can therefore be used to upgrade existing systems with little or no change.

Schematic and Connection Diagrams



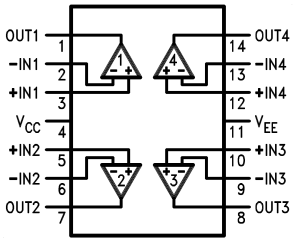


Figure 1. PDIP Package
Top View
See Package Number D0014A or NFF0014A

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ABSOLUTE MAXIMUM RATINGS(1)(2)

Supply Voltage, V_{CC}/V_{EE}	±18V
Differential Input Voltage, V_{ID} (3)	±30V
Common Mode Input Voltage, V_{IC} (3)	±15V
Power Dissipation, P_D (4)	1.2W (N) 830 mW (M)
Operating Temperature Range, T_{OPR}	−40°C to +85°C
Storage Temperature Range, T_{STG}	−60°C to +150°C
Soldering Information PDIP Package Soldering (10 seconds)	 260°C
SOIC Package Vapor Phase (60 seconds)	 215°C
Infrared (15 seconds)	220°C
ESD rating to be determined.	
See http://www.ti.com for other methods of soldering surface mount devices.	

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which ensure specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not specified for parameters where no limit is given, however, the typical value is a good indication of device performance.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
(3) Unless otherwise specified the absolute maximum input voltage is equal to the power supply voltage.
(4) For operation at ambient temperatures above 25°C, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance, junction to ambient, as follows: LM837N, 90°C/W; LM837M, 150°C/W.

DC ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_S = ±15V

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage	R_S = 50Ω		0.3	5	mV
I_{OS}	Input Offset Current			10	200	nA
I_B	Input Bias Current			500	1000	nA
A_V	Large Signal Voltage Gain	R_L = 2 kΩ, V_{OUT} = ±10V	90	110		dB
V_{OM}	Output Voltage Swing	R_L = 2 kΩ	±12	±13.5		V
		R_L = 600Ω	±10	±12.5		V
V_{CM}	Common Mode Input Voltage		±12	±14.0		V
CMRR	Common Mode Rejection Ratio	V_{IN} = ±12V	80	100		dB
PSRR	Power Supply Rejection Ratio	V_S = 15 ~ 5, −15 ~ −5	80	100		dB
I_S	Power Supply Current	R_L = ∞, Four Amps		10	15	mA

AC ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_S = ±15V

Symbol	Parameter	Condition	Min	Typ	Max	Units
SR	Slew Rate	R_L = 600Ω	8	10		V/µs
GBW	Gain Bandwidth Product	f = 100 kHz, R_L = 600Ω	15	25		MHz

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DESIGN ELECTRICAL CHARACTERISTICS

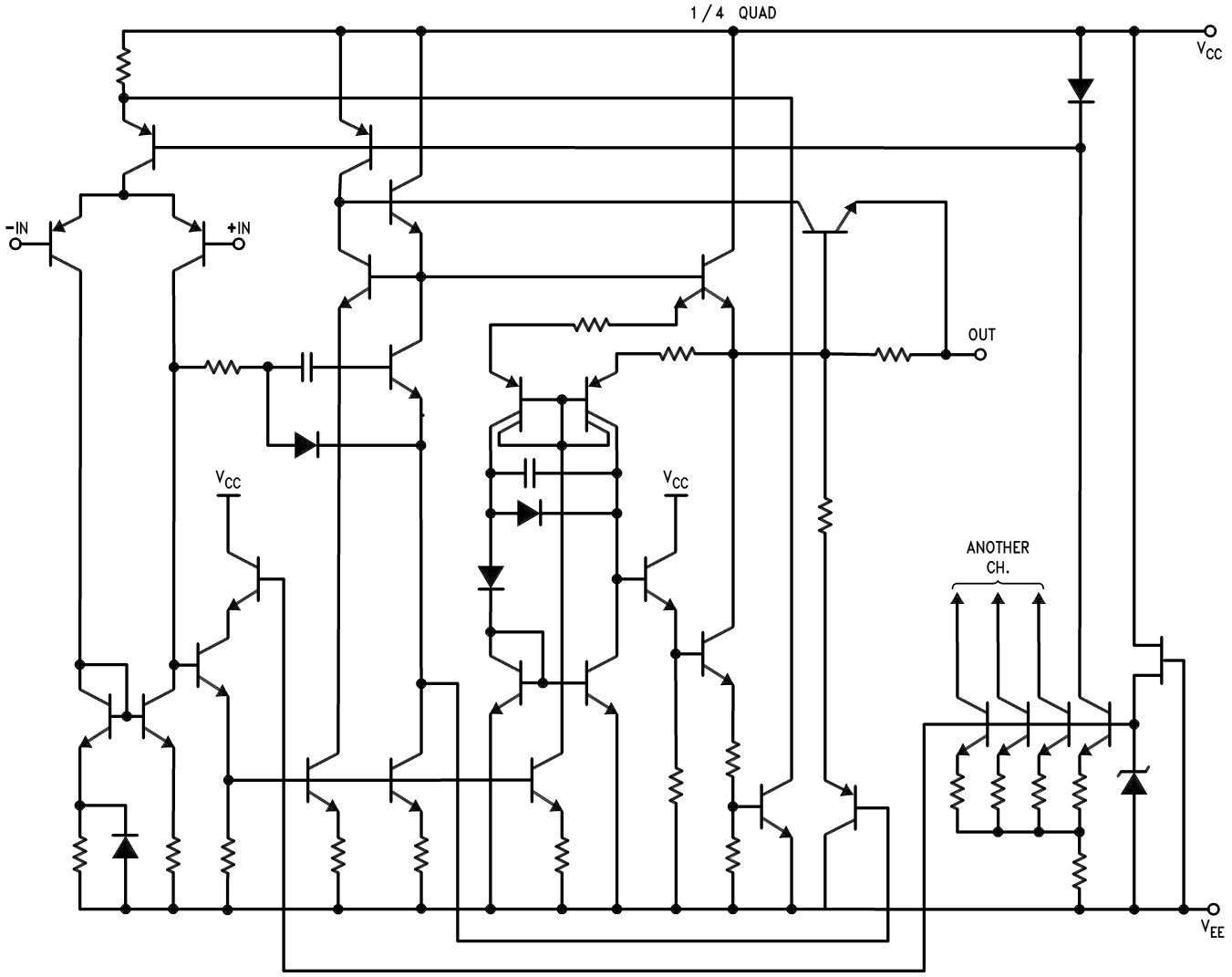
T_A= 25°C, V_S=±15V (1)

Symbol	Parameter	Condition	Min	Typ	Max	Units
PBW	Power Bandwidth	V_O = 25 V_{P-P}, R_L = 600Ω, THD < 1%		200		kHz
e_{n1}	Equivalent Input Noise Voltage	JIS A, R_S = 100Ω		0.5		μV
e_{n2}	Equivalent Input Noise Voltage	f = 1 kHz		4.5		nV/ $\sqrt{Hz}$
i_n	Equivalent Input Noise Current	f = 1 kHz		0.7		pA/ $\sqrt{Hz}$
THD	Total Harmonic Distortion	A_V = 1, V_{OUT} = 3 Vrms, f = 20 ~ 20 kHz, R_L = 600Ω		0.0015		%
f_U	Zero Cross Frequency	Open Loop		12		MHz
φ_m	Phase Margin	Open Loop		45		deg
	Input-Referred Crosstalk	f = 20 ~ 20 kHz		−120		dB
$\Delta V_{OS}/\Delta T$	Average TC of Input Offset Voltage			2		μV/°C

(1) The following parameters are not tested or ensured.

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DETAILED SCHEMATIC



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TYPICAL PERFORMANCE CHARACTERISTICS

Maximum Power Dissipation vs Ambient Temperature

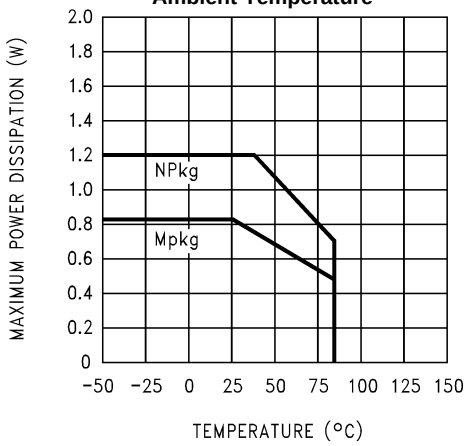


Figure 2.

Normalized Input Bias Current vs Supply Voltage

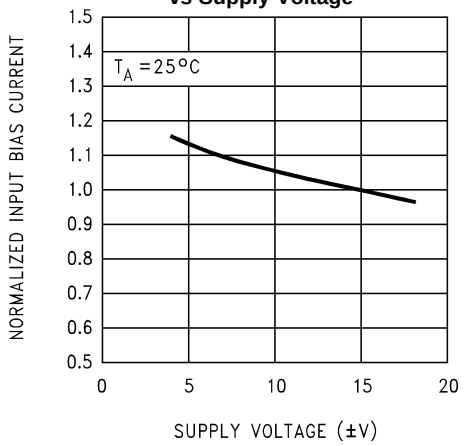


Figure 3.

Normalized Input Bias Current vs Ambient Temperature

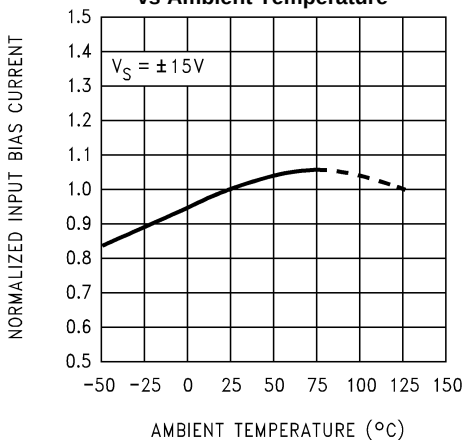


Figure 4.

Supply Current vs Supply Voltage

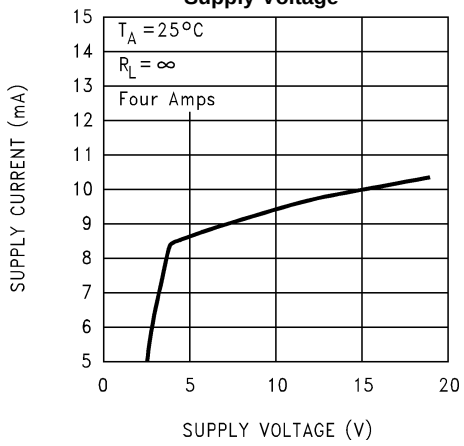


Figure 5.

Supply Current vs Ambient Temperature

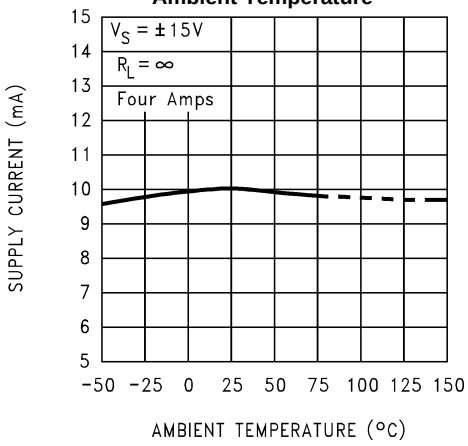


Figure 6.

Positive Current Limit

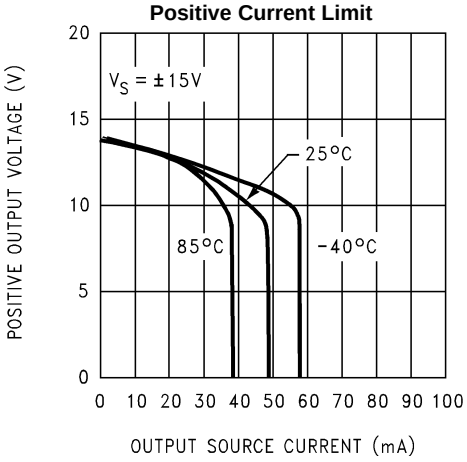


Figure 7.

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Negative Current Limit

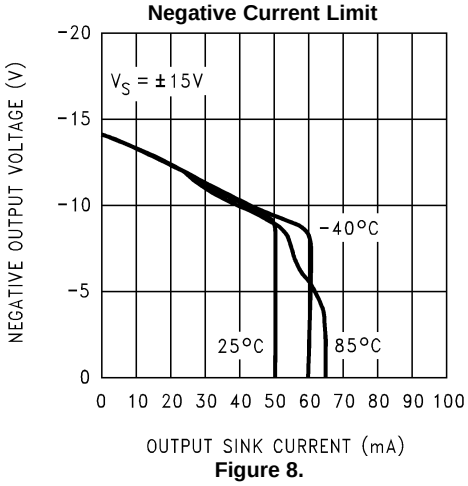


Figure 8.

Maximum Output Voltage vs Supply Voltage

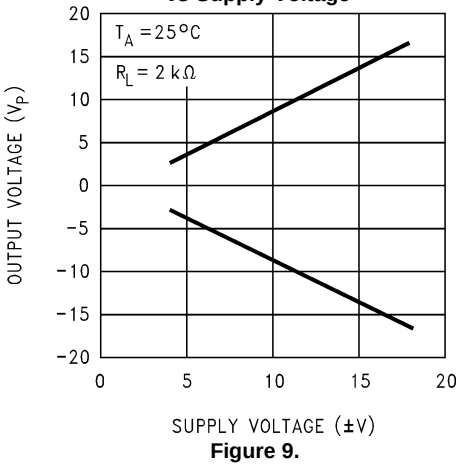


Figure 9.

Maximum Output Voltage vs Supply Voltage

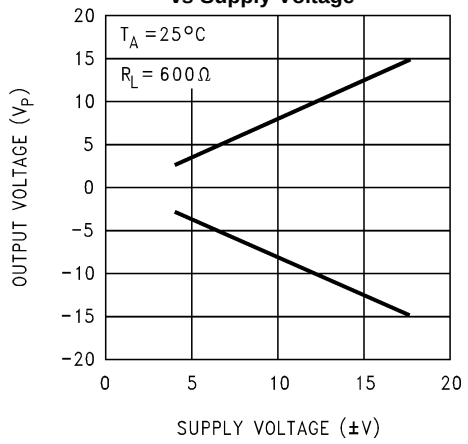


Figure 10.

Maximum Output Voltage vs Ambient Temperature

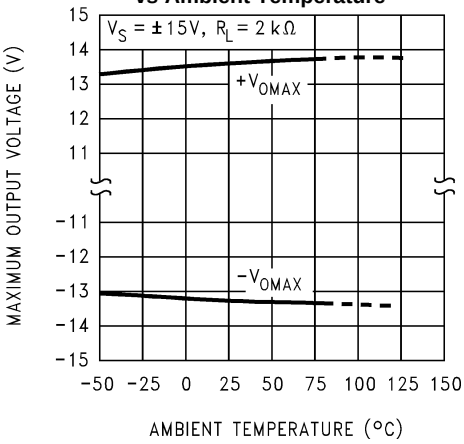


Figure 11.

Maximum Output Voltage vs Ambient Temperature

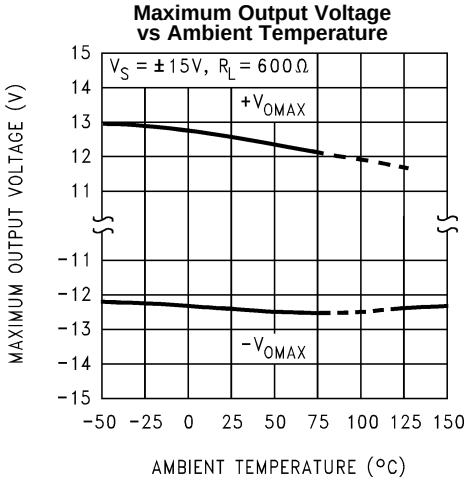


Figure 12.

Power Bandwidth

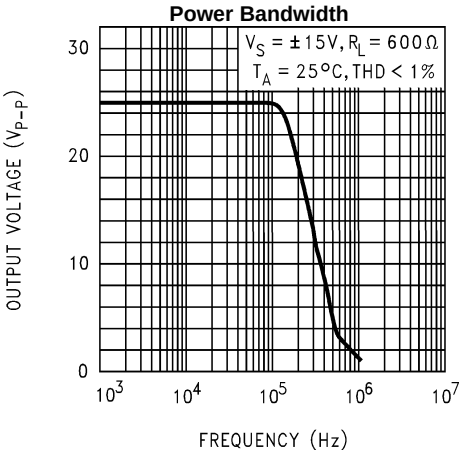


Figure 13.

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Normalized Slew Rate & Gain Bandwidth vs Supply Voltage (f = 100 kHz)

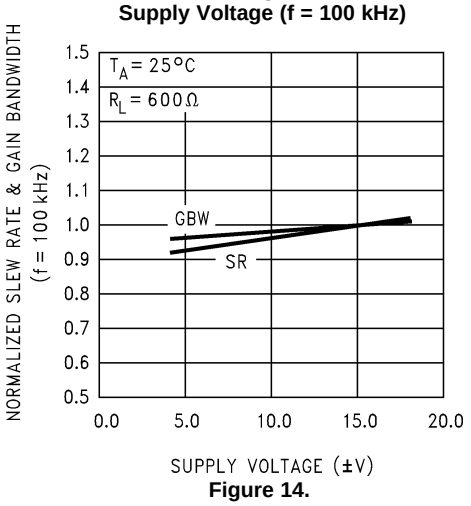


Figure 14.

Normalized Slew Rate & Gain Bandwidth (f = 100 kHz) vs Ambient Temperature

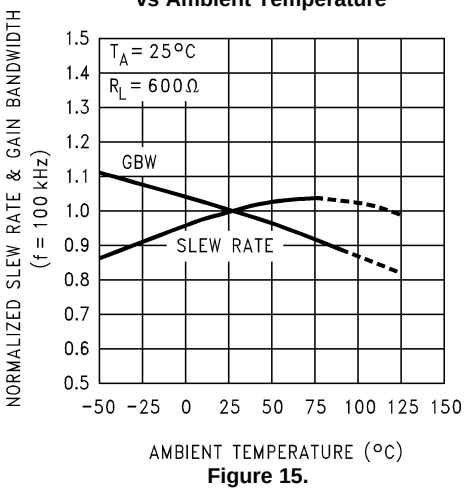


Figure 15.

Voltage Gain vs Supply Voltage

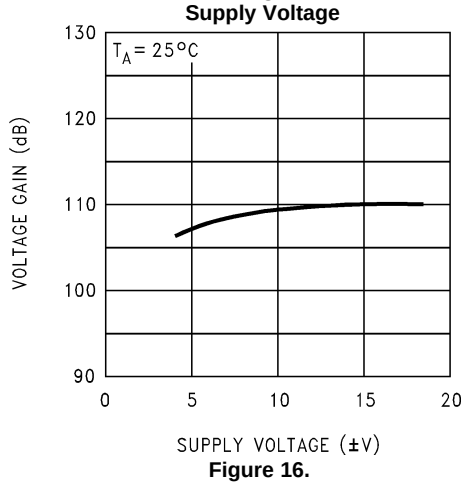


Figure 16.

Voltage Gain vs Ambient Temperature

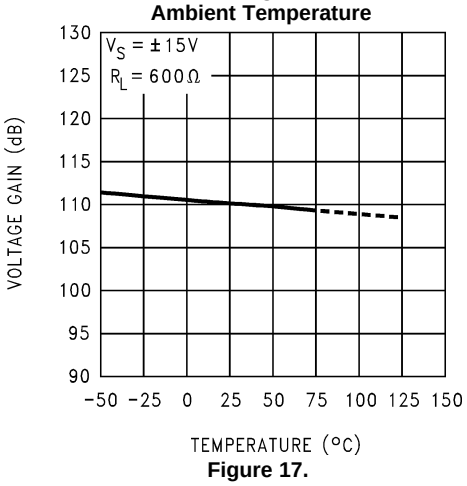


Figure 17.

Power Supply Rejection vs Frequency

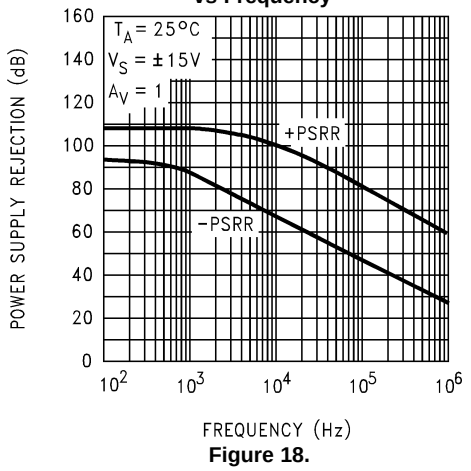


Figure 18.

CMRR vs Frequency

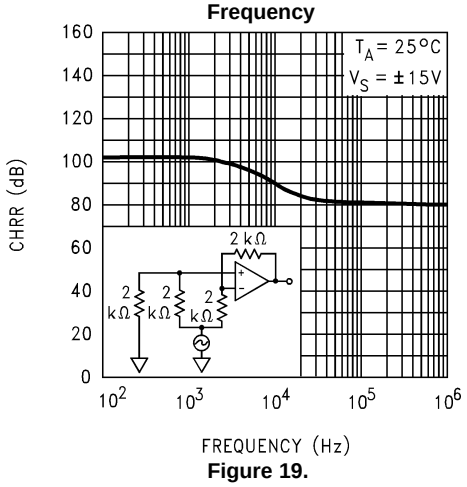


Figure 19.

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Open Loop Gain & Phase vs Frequency

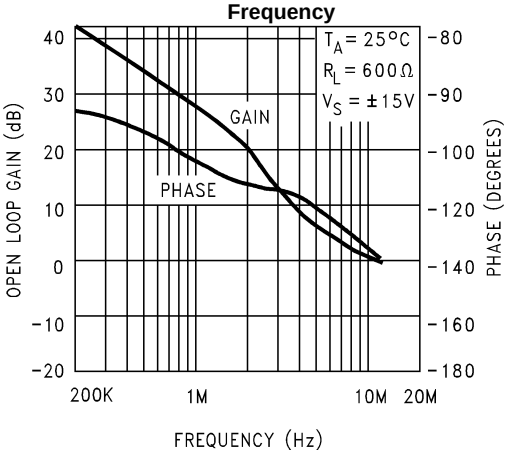


Figure 20.

Total Harmonic Distortion vs Frequency

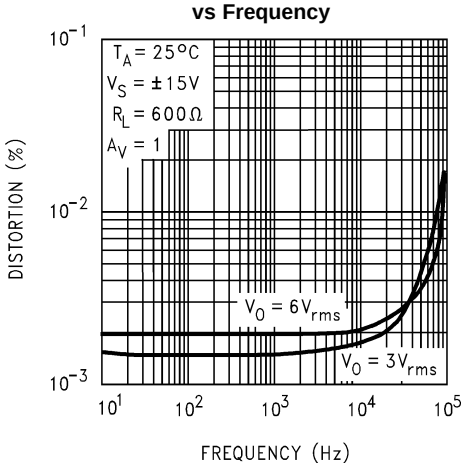


Figure 21.

Equivalent Input Noise Voltage vs Frequency

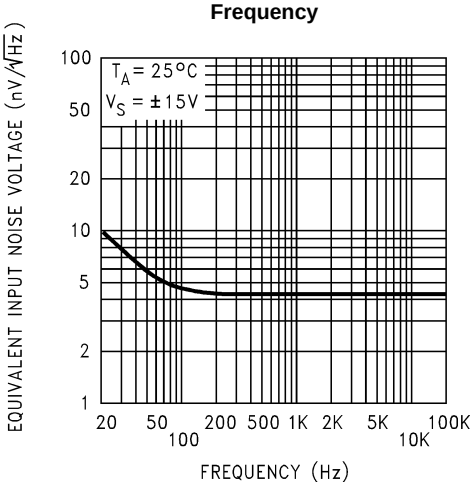


Figure 22.

Equivalent Input Noise Current vs Frequency

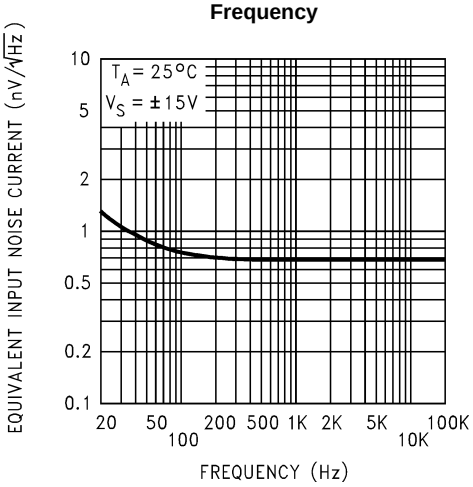


Figure 23.

Small Signal, Non-Inverting
T_A = 25°C, A_V = 1, R_L = 600Ω, V_S = ±15V

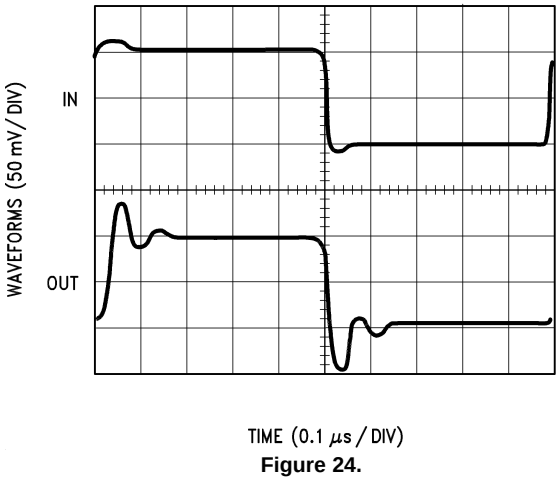


Figure 24.

Current Limit
T_A = 25°C, V_S = ±15V, R_L = 100Ω, A_V = 1

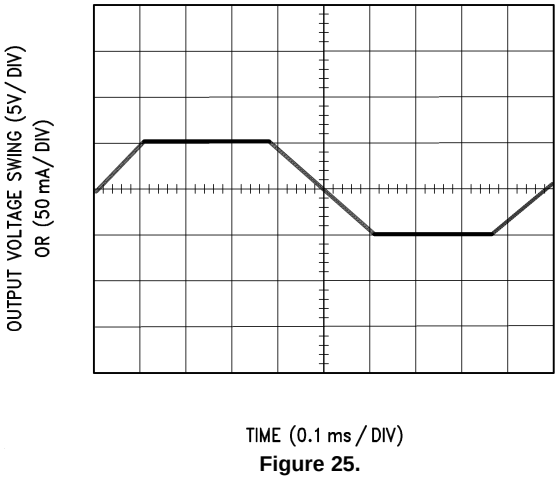


Figure 25.

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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Large Signal Non-Inverting
T_A = 25°C, R_L = 600Ω, V_S = ±15V

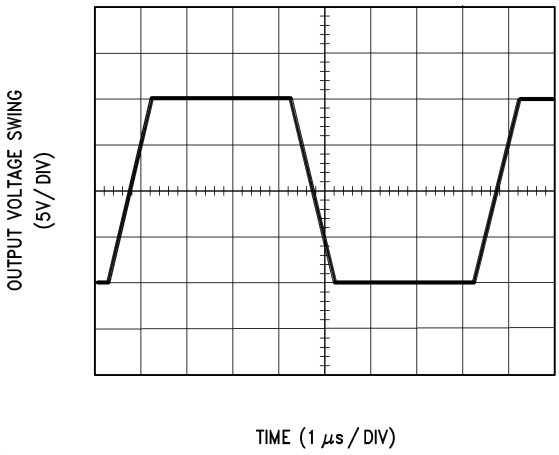


Figure 26.

Large Signal Inverting
T_A = 25°C, R_L = 600Ω, V_S = ±15V

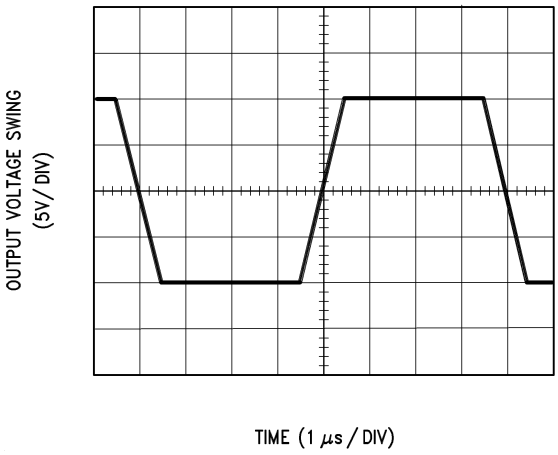


Figure 27.

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REVISION HISTORY

Changes from Revision B (March 2013) to Revision C	Page
• Changed layout of National Data Sheet to TI format	5

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM837MX/NOPB	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	SN	Level-1-260C-UNLIM	-40 to 85	LM837M	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

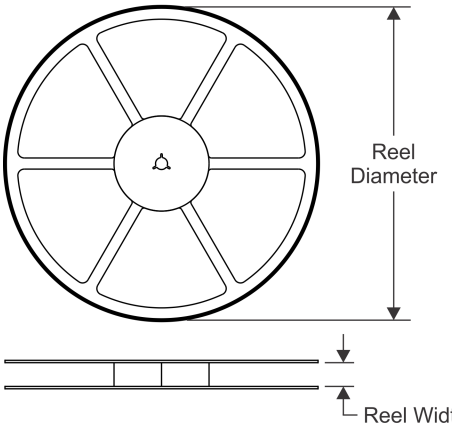
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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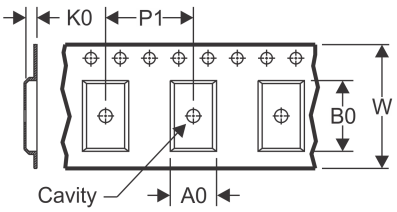
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

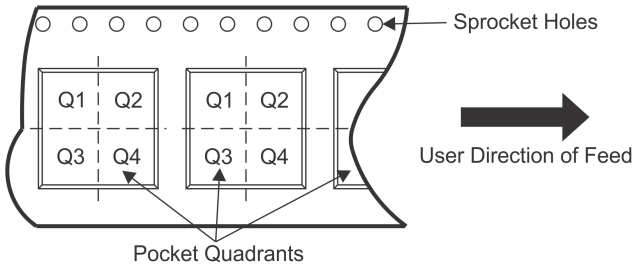


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

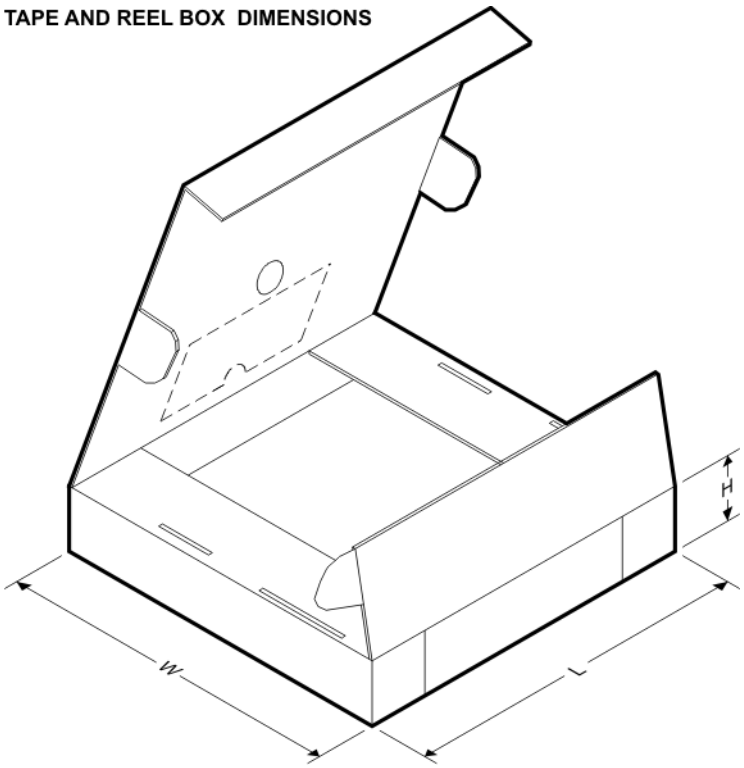
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM837MX/NOPB	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1

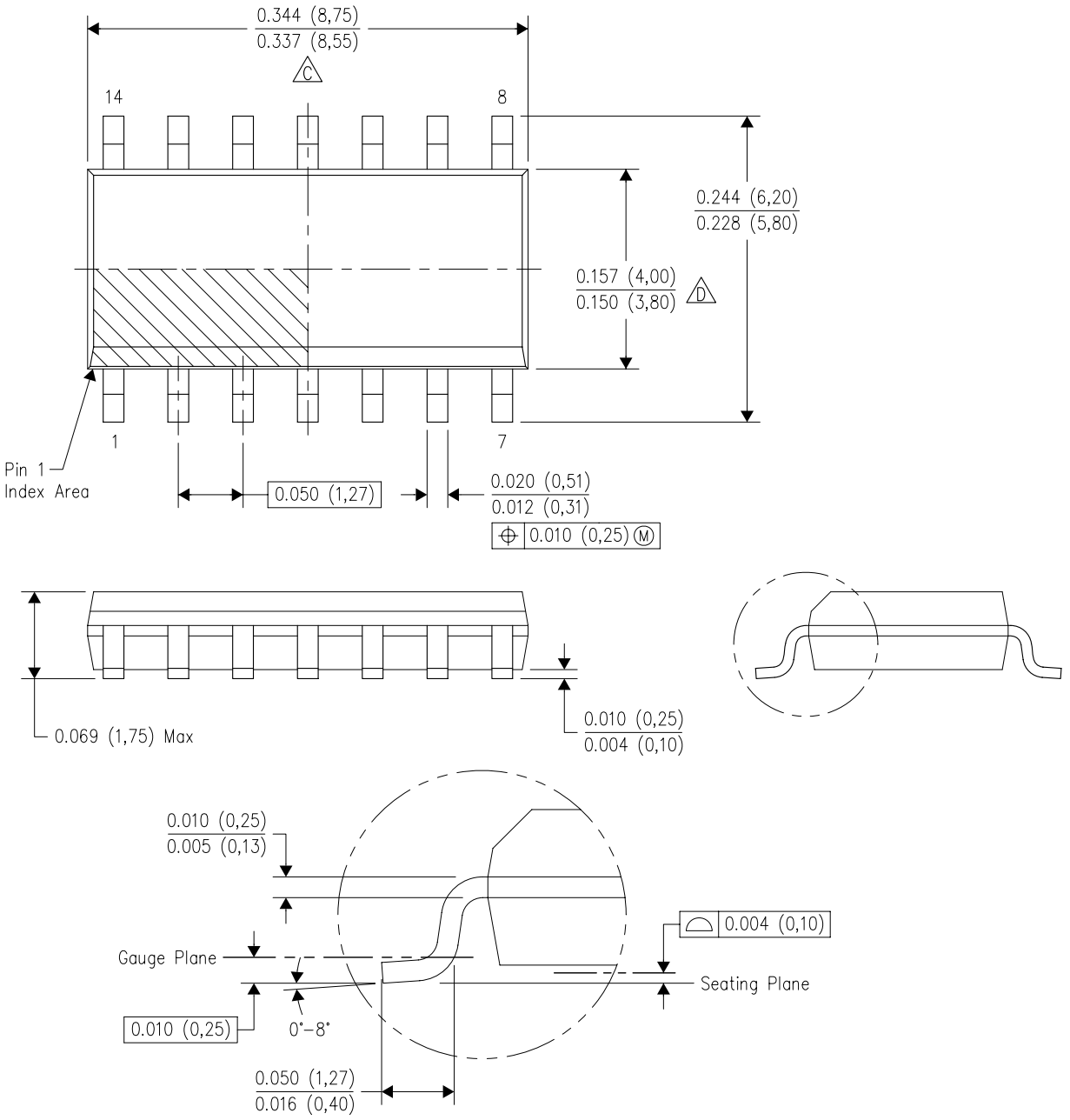
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM837MX/NOPB	SOIC	D	14	2500	367.0	367.0	35.0

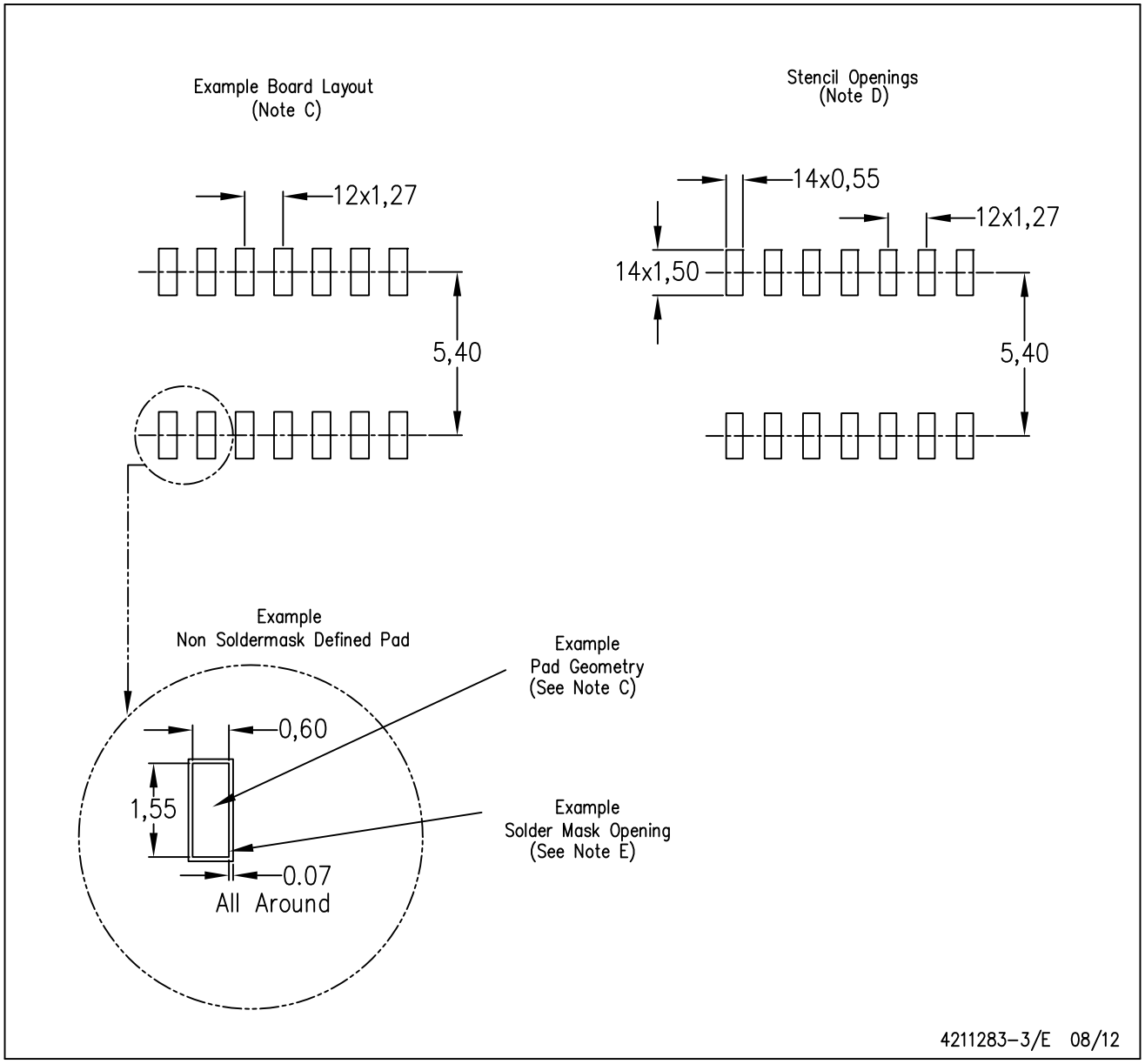
D (R–PDSO–G14) PLASTIC SMALL OUTLINE



4040047–5/M 06/11

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AB.

D (R–PDSO–G14) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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